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QUARANTINE,

ITS ADVANTAGES

AND

DISADVANTAGES.

THE D. H. CAMA PRIZE-ESSAY FOR 1885.

BY

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70271

BOMBAY:
PRINTED AT THE "EXAMINER PRESS, FORT.
1886.

QUARANTINE,

ITS ADVANTAGES AND DISADVANTAGES.

FEW questions can be considered of more practical importance than the subject that has been laid before us for discussion in this essay. This time is the most opportune, as now it is engaging the serious attention of diplomatists and scientific men, who are assembled together at Rome to devise some means to prevent further extension of cholera into Europe. Quarantine has been levied now more than three centuries, and the results have been far from satisfactory. Individuals, communities and nations whose interests are affected by it have as much right to ask as it is the duty of enlightened governments to show that the inconveniences and burdens of restrictive and other measures are counterbalanced by real and solid advantages. But unlike other legislative acts, which are only passed after mature deliberation and much thought, quarantine systems were generally devised under the influence of panics from which even the leaders of government were not free, and which is amply demonstrated in the history of quarantine. Not till the end of the second or beginning of the third decade of the 19th century did it strike those, whose duty it was to guard the sanitary interests of nations to watch the practical working of a scheme on the result of which depended the welfare of mankind. So firm was their traditional faith in quarantine that they were blind to the true cause of its failures, attributing them rather to administrative errors than to an inherent impracticability. Nor were there wanting apparent successes to lull them into this calm of inactivity and false security under the protection of quarantine—successes due rather to a natural decline of the disease than to any palliative influence exerted by quarantine. Attention was first directed to the subject by the new element introduced into the causation of diseases which even until then were believed to be propagated by human contagion alone, and when the influence of local conditions began to be recognized by medical men this received practical expression in the relaxation of the stringency of quarantine laws. Since, opportunity has not been wanting for watching the practical working of quarantine systems by different countries with respect to different diseases.

It is much to be regretted that, notwithstanding the disinterested and zealous labours of numerous workers, we have not arrived at anything like certainty as to the causation and intimate pathology of the diseases against which quarantine is enforced. A knowledge of the behaviour of contagia, its mode of entrance into the system, and an insight into the unknown forces that govern the origin, spread and decline of epidemics would be desirable before we attempted a final and scientific solution of the question. If the germ-theory of cholera, for instance, were proved, we could by investigating into the life-history of the bacillus arrive at an approximate or tolerably correct idea as to the conditions necessary for the vitality of the germ, and, applying it to the present question, ascertain whether isolation or quarantine of a certain duration fulfils these conditions. Even if correct ideas of the causation of disease were not to lead us to efficacious modes of treatment, they would at least remove prejudices in favour of quarantine based on theoretical assumptions rather than on approved facts. But our ignorance is still greater : it is not enough that we should be unacquainted with the minute particles or organisms that constitute the essence of contagion; but we should find a diversity of opinion as regards the contagious character of at least two of the three diseases with which quarantine is associated. Notwithstanding what Mr. John Simon said to the contrary in 1866, the medical profession is divided into two camps—contagionists and anti-contagionists. The contagionists' side is represented by universal medical opinion in Europe; on the other side we have the high authority based on Indian experience of Drs. Cunningham, Lewis, Hunter and others.

Dr. Cunningham, some time Sanitary Commissioner to the Government of India, came, after a long experience of cholera in India and especially of the epidemic of 1872, to the conclusion that cholera as observed in India did not furnish any proof of the contagious character of the disease—a result directly contradictory to unanimous medical opinion in Europe. When doctors of such eminence disagree, it is impossible for governments to come to a mutual understanding as to the value of quarantine in cholera. But notwithstanding these difficulties, our practical experience of the administration of quarantine during the present century ought to furnish us with a sufficient number of facts to convince even the most sceptical that the system of quarantine if not illogical and based on false or partial theories of contagion is at least impracticable and useless. The question of quarantine is a momentous and pressing one, and cannot be deferred until our ideas of the pathology of specific disease become clearer or until we

should be fortunate enough to discover specific antidotes by which mankind would be rendered proof against the evil effects of poisons that have entered his system. It is impossible to wait until such a happy consummation, for restrictive measures are not innocent methods of treatment that could be allowed to continue for an indefinite period on account of their harmlessness, but their maintenance imposes heavy burdens on state, at the same time that they interfere with the welfare, convenience, happiness,—nay, the very existence of communities.

Communicable, transmissible or infectious diseases may be classified under four heads:—

I. Purely contagious diseases like small-pox in which the contagium after entering the system undergoes there an immense multiplication and appears in the morbid products or exhalations of the body as in smallpox and scarlet fever. Typhus and plague may come in this division.

II. Miasmatic diseases in which the noxious agent is originated outside the body and generally believed to be the product of vegetable decomposition in marshes and other localities favourable to its production.

In the commoner forms of malarial (remittent and intermittent) fevers—typical examples of miasmatic diseases—there is nothing to show that these diseases are transmissible from individual to individual. There appears to be one exception however to the general rule of the non-contagious character of miasmatic diseases if we accept that view of the pathology of yellow fever which maintains the identity of that disease with remittent and intermittent malarial, and which is based on clinical experience of some that these three diseases are convertible into one another, the intensity of the poison and constitutional causes modifying the characters of the disease.

III. Liebermeister makes a subdivision of miasmatic diseases, designating it "miasmatic contagious" under which he would include diseases like cholera and typhoid fever in which, according to the general opinion, the causative agent must first be given off by the body, commonly in the excreta, and afterwards undergo preparatory changes somewhere in the soil or water before they can give rise to the disease in others.

The special cause of the disease after entrance into the system does not give rise at once to morbid manifestation of system contamination, but a varying period which differs for every disease elapses. During this period of what is called incubation a person affected with the disease may be moving about and

communicate the disease to others without the slightest suspicion. The period of incubation is taken into consideration in fixing how long infected ships ought to be detained after the last case on board. Human contagion is not the sole factor in the spread of disease, for even outside the endemic areas of miasmatic diseases, where the soil is continually replenishing the earth with fruitful sources of disease, atmospheric and climatic influences play a most important part in the periodical recurrence of disease in communities and in the wider extension of disease in several countries. Watching the spread of disease in communities, it is observed that epidemics unaccountably attain a special accession of spreading power and in rarer instances of malignancy—facts which have led some writers to attribute the smaller epidemics to physical and moral conditions of communities. The more extensive outbreaks, pandemics or secular evolutions as Charles Anglada terms them, appear to have some relation with undetermined cosmical phenomena. Meteorological changes are now being studied as a possible explanation of recurring epidemics, and Dr. Bryden shows that cholera epidemics in India have definite relations to particular meteorological phenomena. It is therefore probable that hidden causes have a perceptible influence on the course of contagious diseases. The practical inference may be drawn from these observations that quarantine, which deals with only one of the elements in the causation of contagious disease and does not in any way affect the others, cannot be regarded as a complete remedy against contagious diseases unless complemented by measures designed to improve the physical and moral condition of man.

Quarantine may be defined in the words of Dr. Leach as the "enforced isolation of individuals and certain objects, coming "whether by sea or land from a place where dangerous communi- "cable disease is presumably or actually present, with a view of "limiting the spread of the disease. The objects liable to quaran- "tine include, on the assumption of their aptness to carry the "contagia, luggage and personal effects of individuals isolated, "certain articles of merchandize and ships; and, in land quarantine, "carriages and other vehicles." Quarantine dates its origin in the 15th century when theories of contagion were defined by scientific men of the day and the principle of isolation until that time applied to leprosy was extended to plague. After the extinction of the former disease, the old lazarets, having no further use, were converted into quarantine stations, retaining however their old designation to the present time. The term quarantine is of very ancient date, and originated in a superstitious

belief of Hippocrates that forty days was the usual period for the completion of many diseases. Quarantine is but an extension of the principle of isolation to communities—the latter is applicable to individuals or small collection of individuals as in the wards of an hospital. The success that attends measures of isolation depends in a great measure on attention to minute details and the completeness with which these are carried out. Observation has shown that mere separation is not enough; it is essential that the room in which the patients lie be practically cut off from the rest of the house; nothing that enters it ought to leave without the most thorough disinfection; special precautions have to be taken that the clothes of the nurse or the instruments or physician's hands do not carry the infection. But not in a few cases, in spite of the utmost care, the disease escapes and attacks the other members of the family or suddenly appears in the non-contagious wards of an hospital through some slight negligence on the part of the nurse or some slight omission. These difficulties are multiplied to an indefinite extent in quarantine, while a most trivial cause, as the ignorance or negligence of a sanitary officer, may—granted its efficacy—frustrate the best conducted system of quarantine. The operation of isolation is restricted by one of the characters of some contagious diseases, namely the portability of the causative agent or the distance to which it can be carried independently of human agency as well as by those external conditions already alluded to.

Quarantine is at present enforced against three contagious diseases: cholera, plague and yellow fever; for the others simpler methods are considered sufficient. I shall limit my remarks to these, treating each of them separately in a theoretical and practical point of view in relation to quarantine. The theoretical part will deal with the grosser facts in their pathology to enable us to understand with regard to each disease the theoretical basis on which the superstructure of quarantine rests. The practical or experimental part will contain a short historical outline of different epidemics that have from time to time visited the human family, the conferences of scientific men that have been assembled on these occasions, their recommendations and the practical adoption of these by different nations. This division of the subject is especially useful from the point of view quarantine is considered in this essay, viz., as a preventive remedy against contagious disease. To estimate the therapeutic value of any drug in any disease, we ought first to consider how far the morbid condition of a disease is likely to be modified or altogether removed by the remedy, from what we know of the general phy-

siological action of the drug or its effect in similar diseases; the conclusions arrived at by such an enquiry must be tested by actual experience before they are generally accepted. An acquaintance with the natural history of the disease is presupposed in such observations, and the historical outline cannot on this account be considered irrelevant to the question in hand.

The most certain evidence of transmissibility is transference of the disease by inoculation; but experiments on men and animals have led to negative results with cholera. Another proof is derived from the observation, that persons whose duties bring them into close communication with the sick, such as medical officers, nurses and ward-boys, are affected in greater proportion than other members of the community. Dr. Cunningham's observations on cholera tend to show that attendants on cholera patients are not more liable to suffer than others, and he also brings forward statistics to prove his assertion. "The fact is," he says, "that during 1876 "and 1877 in this (Bengal) Presidency 422 cases were treated in "101 hospitals, 1301 attendants came into almost constant commu- "nication with the sick—only 18 out of them suffered from any "symptoms of cholera." The German Cholera Commission of the epidemic of 1873 came to a similar conclusion of the non-transmissibility of the disease by personal contact; for during the entire epidemic in Germany only six fatal cases of cholera were recorded among the ambulance and medical staff, including attendants and visitors. Experience has also satisfactorily established that the removal of the healthy from an infected locality to tents and isolation of the sick has been attended with the most successful results in India. This fact is not irreconcilable with the above, as it can be explained on the theory of an indirect contagion. These measures were first suggested by Surgeon General Murray in 1866 and tried successfully with the European troops then stationed at Agra and are now generally adopted by Government. "The total saving of life," says Dr. Murray in the August (1879) number of the *Practitioner*, "during the sixteen years that removal "has been practised has been 18,152. The mortality among the "European troops in eleven of the military stations was 14·90 per "1,000 previous to removal and 6·69 per 1,000 subsequently." Dr. Cunningham cannot deny the truth of this statement, but is not prepared to acknowledge its dependence on any contagious character of the disease. In his report for 1877, page 82, he says: "The removal of the affected men from the locality has proved "of signal service in the case of troops and prisoners; but this mea- "sure also, *although founded on no theory of contagion*, is one which, "however much it may be recommended, can never be ordered by

"Government." Dr. Murray, in the July 1879 number of the *Practitioner* takes exception to the statement that this measure was founded on no theory of contagion, and says that being the only responsible medical authority on whose recommendation the measure was instituted in 1862, he then stated in a report to the Special Commission appointed on the occasion that removal was founded on the principle that the disease is communicable. Dr. Murray takes the same opportunity to criticise Dr. Cunningham's explanation. I quote his words: "Dr. Cunning-"ham rather approves of Dr. Bryden's theory of the aerial wave of "epidemic being by some unaccountable cause localized in a sta-"tion, but this same theory would prevent removal being beneficial "unless it was to a place beyond the influence of the epidemic "wave, which in 1877 extended all over India." I have especially dwelt upon the two facts cited above, as neither Dr. Cunningham's explanation nor the theory of direct contagion can account for both of them. We must therefore seek for an explanation in theories of indirect contagion. Dr. Snow in 1866 started a theory that the specific virus is contained in the cholera stools and may gain access to water or in a dried condition adhere to clothing. Dr. Parkes instances a large number of cases in which an outbreak of cholera was traced to an impure water-supply, and is also inclined to believe that the appearance of cholera among the pilgrims on the bathing day at Hurdwar was a "case of water poisoning on a gigantic scale." German experience however does not seem to accord with this view, and Dr. Pettenkoffer advocates the doctrine that germs of cholera exist in the stools of such patients, which may, under favourable conditions of heat and moisture, be developed in the soil into true cholera poison. In the recent conference at Berlin, Dr. Pettenkoffer raised some objections to Koch's theory, based on the observation, that Koch's bacillus cannot be developed in the soil. Dr. Cunningham objects to the water theory on the ground that it "insists on the requisite "but it does not insist it on a sufficiently wide and logical basis. "As regards cholera, the only danger in the water-supply according "to this theory is the danger of its containing cholera discharges. "Other impurities may exist in abundance, but without the suppos-"ed germ there can be no outbreak. But this view is insufficient "especially as it is based on purely theoretical considerations." Only two cases are recorded in which an outbreak of cholera has been directly traced to cholera excreta; one instance reported by Dr. Radcliffe in East London in 1866, and the more recent one, the well known Macnamara's case, graphically described by him in *Quain's Dictionary of Medicine, Art. Cholera.*

Koch's discovery of the comma bacillus in the intestinal evacuation of persons affected with this disease is only a further development of the contagion theory of cholera, and even if it can be satisfactorily proved by inoculation or experiments on animals that the comma bacillus is the true and specific germ of the disease capable of being *directly* communicated by the sick, the theoretical plea of quarantine would be complete; but the practical side of the question remains unaffected. It is not a matter for surprise that at the recent Conference at Rome, Dr. Koch should be one of the strongest supporters of a scheme for the levying of a rigorous quarantine at Suez for arrivals from infected ports. As to the period of incubation, the Conference of 1866 came to the conclusion that in the majority of cases it did not exceed a few days, and the few cases that were brought forward to prove a longer duration were not characteristic ones and probably included the duration of the premonitory diarrhœa in the reckoning. Professor Hirsch fixes it at three or four days as the result of German experience. Based on the first mentioned data, the duration of rigorous quarantine was laid down by the Conference as ten clear days after admission into the lazarets. Cases of premonitory diarrhœa were to be considered suspicious and not allowed free *pratique* until they had subsided or it was satisfactorily proved by medical examination that the diarrhœa was not choleraic.

The arguments of the Conference of 1866 for the transmissibility of cholera are proofs taken from the progress of epidemics generally considered. Cholera has nearly always chosen the great paths of communication, and whether it chose a land or sea route it always followed the direction of human currents. The epidemics which have reached Europe from India and especially that of 1866 are considered good evidence in support of this. The epidemic of 1866 broke out at Mecca during the feast of Courban Bairam and following on the wake of the pilgrims; it then appeared at Alexandria. From Alexandria it radiated in all directions to other seaports of the Mediterranean, from which places the railways carried it throughout the whole Continent. The first appearance of cholera in a maritime town, generally the chief port, before it spread over an island, and the great rapidity of this epidemic, which leaving India at the end of winter, Mecca at the end of May, reached America in the space of nine months, are, in the opinion of the Conference, additional proofs of the propagation of cholera by human intercourse. Dr. Netten Radcliffe is of the same opinion, and in speaking of the diffusion of cholera by human intercourse, says: "But reviewing "the whole circumstance of the diffusion of cholera westwards

"and northwards of India from 1865-1874, I have elsewhere had "occasion to express the opinion that wherever it has been "possible to follow the diffusion in detail, its history has been "that of a dissemination by human intercourse. Wherever the "details of that diffusion have failed, I am unaware of any other "suggestion which would explain the successive chronological "phenomena."

In India epidemics have also been frequent in connexion with pilgrimages and fairs, when immense crowds of pilgrims resort to Hindoo places of worship that they might offer their homage to their favourite deity. The most celebrated are Muttra, Allahabad, and Mirzapore in the Bengal Presidency; Mahadeo and Juggurnath in Southern India, and Sholapore and Sungum in the Bombay Presidency. To these places pilgrims from all parts of India resort, and, after a tiresome journey of thousands of miles, are crowded together under the most insanitary conditions, thus forming suitable foci for the origin of an epidemic. When these crowds disperse in every direction, they serve as carriers of the disease to all parts of the land. The same conditions are found in the pilgrimages to Mecca, the only difference being that in the latter case cholera has to be introduced from an endemic centre. Dr. Murray, in a paper in the *Practitioner*, has ably demonstrated that pilgrimages and fairs are fertile causes of the diffusion of cholera in India. The progress of the European epidemics along paths of human communication together with the common occurrence of cholera outbreaks in connexion with pilgrimages and fairs led the Conference of 1866 to the conclusion that the cholera virus was "carried in all direc-"tions by his agency only and in rapidity corresponding with his "movements, and that it develops itself most severely in those "places which abound in bad insanitary conditions." The Conference of 1874 confirmed this conclusion, modifying it so far as to lay greater stress on the nature of the locality than on personal intercourse apart from the locality. The meaning of the Conference will be better understood by quoting the unanimous conclusion which runs as follows: "Cholera is transmissible by "man coming through an infected medium, *but man is not considered* "*as the specific cause apart from the locality*. He is regarded as the "propagator of cholera when he comes from a place where the "germ of the disease already exists." It is a remarkable fact that in the last epidemic in Southern Europe, although cholera was prevalent at Perpignan, a town situated near the mountainous districts of the Pyrenees, the little communication that exists between the two countries on account of the natural barrier

between them, prevented any extension of the disease by land. It is very probable therefore that Alicante, the first town on the coast of Spain that was attacked, received its contagion from French ports either directly or indirectly through Algiers or some town in the neighbouring coast of Africa. In the Berlin Conference the influence of human intercourse on the dissemination of the disease was warmly discussed. Dr. Koch opened the discussion by giving instances of the spread of cholera by human intercourse, pilgrimages and ships. Dr. Pettenkoffer admitted the dissemination of cholera by human intercourse, but did not consider it suficient to arouse an epidemic without the cooperation of local and seasonal influences. He could not see how a single case of cholera on board a ship could give rise to an epidemic, but was inclined to believe that its extent depended on the number of vessels attacked. Professor Virchow also said that the influence of local conditions could not be accounted for on the germ theory, as until now not a single case could be brought forward by which the existence of the germ in the soil had been proved. The communicability of the disease had better be proved by separate cases. He cited cases of cholera which had no connexion whatsoever with the soil, and could only have been transmitted by individuals. One occurred in a prison house and another on board the Stetten Transatlantic Steamer "Franklin".

A complete system of quarantine includes the detention of baggage and merchandize in general as well as of individuals. Is there any reason to suppose that such articles can convey the disease? In the unsettled state of our knowledge on the subject of cholera, it is not to be expected that we should be better acquainted on the question of the propagation of the disease by merchandize than transmission by direct contact. I shall therefore insert the questions and answers as laid down in the reports of the Sanitary Conferences of 1866 and 1874 without in any way commenting on them. What are the means by which cholera is conveyed in distant intercourse, ships' wares, healthy persons, infected persons? The Conference replies thus: "By means of discharges from cholera patients, whether the attack be exceedingly severe or so slight as to be hardly recognizable, articles of clothing, houses and ships may become polluted and form media for the retention or transmission of the disease." The Conference of 1874, in confirming this conclusion, did not see why merchandize in general could not transmit the disease if infected, although facts in support of such an assumption might be wanting. The Conference of 1874 went on still further to determine other means by which the poison might be conveyed to human beings in close intercourse,

such as corpses of those that have died from the disease, cholera stools, food, water and insects. Cholera corpses were to be regarded with suspicion, although the Committee was unable to cite any examples of infection by such.

From the beginning of this century six times has cholera invaded Europe: 1829-37, 1847-50, 1852-56, 1865-67, 1869-73, 1885. During the first epidemic the disease advanced across the Russian frontier, and universal opinion at the time leaned to the belief that the disease was carried by human intercourse. On the second invasion, however, doubts having been raised as to the accuracy of this view, official enquiries were made under the direction of the General Board of Health in England. No evidence of the transmissibility of the disease being available before the Committee to satisfy current ideas as to the nature of contagion, the Board rejected the doctrine of communicability, attributing the disease to an undefinable "epidemic influence," which cooperated with local conditions in originating the disease. The theory was extended to all contagious diseases, and since has influenced medical and scientific opinion in Europe. The universal recognition at the time of such a doctrine, by which human intercourse direct or indirect was attributed, no share in the propagation of cholera dealt a fatal blow to quarantine in England. In England quarantine is now dealt by the Privy Council and the Board of Trade as a purely international commercial question to relieve British commerce from disabilities which would otherwise have been imposed by nations who still adhere to quarantine. The quarantine laws were relaxed by other nations, France however remained firm; and when in 1851 an international sanitary conference was held in Paris, although the General Board of Health had an able exponent of its views in Dr. John Sunderland, who was seconded by the Medical Delegates of Austria and Sardinia, they failed to convince the others, the majority voting in favour of transmissibility. At the commencement of the third epidemic, medical opinion was far from settled on the subject, and the influence of local conditions, in addition to its communicability by direct contact, began to be generally recognized, and a study of the habits of the disease by medical and scientific observers tended to prove that individuals were more likely to catch the infection if living in over-crowded or under defective hygienic conditions. The third epidemic, which lasted from 1852-1856, afforded ample opportunities for the working out of this view, and when cholera appeared in 1866, the Conference that was invited by Napoleon III for the taking of such steps as would prevent further invasions

of cholera by land or sea was better qualified for the task than the previous ones. The results of the labours of these men, representing the science of Europe, are embodied in that admirable volume of resolutions, which, with many exceptions and amendments, were accepted by the Conference of 1874, and represent present medical opinion in Europe as to the theory of contagion in relation to cholera. That portion of the report of the Conference which treats of quarantine is nothing else than an elaborate apology on behalf of quarantine, with practical suggestions which were adopted by the Ottoman, Egyptian, and other governments, with what success we shall presently see. Availing themselves of the experience of former generations, they saw through the mistakes of their ancestors and with the determination of men resolved to amend the errors of the past, they boldly set to their work. They reasoned that a well divised and rational system of quarantine was not inconsistent with the generally accepted theories of their time and more likely to be successful than the arbitrary measures of the earlier period. Hitherto quarantine had failed for want of a fair trial; it was not to be wondered at that they should be sanguine of success as they were making no new experiment nor devising a new system. They attributed the want of success of the primary period of quarantine to the improper use of an instrument which if dexterously handled would not fail to attain its end. They however failed to see the impossibility and impracticability of an Utopian system which, to be effective, must not admit of any leakage; that they had to deal against the insidious importation of a disease, the true nature of which we are not as yet fully acquainted with; and once the disease had passed the barrier the continuance of such measures was unavailing; that these measures were to be taken at the very first explosion of the disease that the very remedy might be converted into a worse disease, as by sanitary cordons and lazarets being attacked and serving to propagate the disease. We of the present day have the good fortune to witness the reformed systems of quarantine working with no better success than the old system during a fifth of a century and especially during the cholera epidemic of 1884-85, when Europe was jealously watching the failure of every quarantine measure organized by the dissenting States that preferred to stick to quarantine rather than adopt the new system of medical inspection recommended by the Conference of 1874.

After the first appearance of cholera in 1830 quarantine measures were adopted in various parts of Europe, and sanitary cordons established on a grand scale in Russia, Prussia and

Germany; but all these measures completely failed, and instead of cutting short the further progress of the disease it had the contrary effect. Between 1847 and 1850 Norway and Sweden spent large sums in organizing sanitary cordons and quarantines throughout the country, but in spite of all these precautions cholera invaded these countries. Already at this time there were not wanting men who had the courage of their opinions, and who even at such an early period in the history of quarantine were able to see the complete failure of these measures.

The Bavarian Commission, in its report on the cholera of 1854, says: "Measures with the object of preventing the importation "of cholera into a country yet uninfected or of stopping its exten- "sion in a place already attacked by means of the interruption of "communications and isolation are *inefficacious, impossible of execution,* "*and injurious.*" Griesenger also denounces quarantine in the following terms: "Military cordons intended to isolate an entire "country are *illusory*: that choleraic diarrhœa by means of which "importation is generally effected *cannot be prevented* by restrictive "measures: that the period of incubation is sometimes long: that "probably Europe will never come to an agreement for the adop- "tion of equal measures everywhere: and that, lastly, the great "interests of commerce will always induce people to elude the "restrictions imposed upon them, and that quarantines, even in "seaports are of very little use." The same German *savant* however allows that it is unfair to quarantine to draw a conclusion from the earlier attempts, as these were generally applied when the disease had already appeared in the country.

The Conference of 1866 condemned the old system of quarantine on various grounds:—

1. The old system of quarantine as that sanctioned by the Conference of 1852 was framed to satisfy two opposite schools—one which firmly believed in the theories of entire and absolute contagionism, and the other implicitly rested its faith on the propagation of the disease through the atmosphere.
2. The conclusions of the Conference of 1852 did not rest on a rational basis, but were arbitrarily laid down, taking no notice of the period of incubation and the premonitory diarrhœa.
3. The doctrines of contagion as to cholera had not been systematized, and consequently no clear conception could be had of the transmissibility of the disease by human contagion or by susceptible goods.

4. No attention was paid to the disinfection of articles.
5. The old lazarets situated in the vicinity of towns on ill-chosen sites and constructed with no regard to ventilation and a proper water-supply were more likely to spread the disease than fulfil the object they were primarily intended for.

No such objections, they maintained, could be brought against the rational system, which was the logical outcome and practical application of admitted principles. The Conference confirmed the distinction between rigorous quarantine and quarantine of observation, a distinction already before recognized by the Sanitary Conference of Paris. Quarantines of observation were generally levied in the case of suspected ships or arrivals from ports whose sanitary condition was a matter of doubt. Such cases did not require more than a temporary detention on board or removal to a lazaret for a few days. The quarantine of observation was applicable to ships with a clean bill of health, the rigors to ships with foul bills required the removal of passengers, crew and goods to a lazaret. It is unnecessary to mention details about the recommendations of the Conference in quarantine matters, as they are contained in the full report reprinted at Calcutta as well as in the shorter abstract compiled by the late Dr. Leith, so well known in this Presidency. A comparison of the quarantine recommended by the Conference with the old quarantine regulations in England published in McCullock's guide would be very instructive if space permitted.

From an examination of the various routes taken by the disease in its progress towards Europe, and adopting as an axiom the principle that the closer measures of quarantine were applied to the primary focus the more certainly would they fulfil their object, the Conference devised an ingenious scheme by which a check could, it was supposed, be put at any stage of the progress of the disease. The quarantine measure now in vogue in the Red Sea formed a part of this scheme. By the land route cholera leaves India through the North Western Provinces into Afghanistan, next through Herat and Meshed into Persia.

Singapore, a great commercial seaport, from which the Mussulmans from Malasia and the Indian Archipelago embarked for Mecca was another centre that served for the rapid diffusion of cholera into Europe. The suggestions of the Conference to shut out cholera by land may be briefly summarised.

1. It being impossible to establish quarantine among the wild tribes of Afghanistan, endeavours to be directed towards

the preservation of Persia. The co-operation of the Persian Government being indispensable, its valuable aid should be asked.

2. The geographical position of Herat and its situation in a narrow defile between mountains afforded the best chances of cutting short the disease at that place.

3. A sanitary service should be instituted on the borders of the Persian Gulf to prevent the entrance of the disease in that direction.

By sea cholera generally landed at Muscat or some seaport on the Eastern Coast, and thence from port to port, thus entering the Red Sea and the province of Hedjaz.

The scheme for the prevention of transportation of cholera by sea included :

1. Measures to prevent the entrance of cholera into the Red Sea.
2. Measures in the Red Sea.
3. Measures in Egypt with a view to protect the Mediterranean ports.

The suggestions of the Conference in this respect were nearly fully carried out, and the existing quarantine stations in the Red Sea were instituted at the recommendation of the Conference. They embrace—

1. A great quarantine establishment at the entrance of the Red Sea near the Straits of Babelmandeb to be both a lazaret as well as a post of observation. Perim on account of its situation was recommended as admirably adapted for such.

2. Sanitary service on the coast of the Red Sea consisting of posts of observation, sanitary officers with varied duties and lazarets. On the African side these posts should be placed at Kosseir, Suakim and Mussowa, all under the Egyptian Government. The chief of these should be at Jeddah. The lazarets to be situated in Elweck and Tor on the Arabian Coast.

3. The measures to be taken if Egypt was invaded were no other than the breaking off of all maritime communication with Egypt for about the space of two months, by which time the disease would be likely to extinguish of itself—an Herculean task, which it must be said in the present complicated commercial relations would be nearly impossible.

The fifth invasion of cholera was first noticed in South Russia, and was by some believed to be due to a revivifying of the dying embers of the previous epidemic. In the space of four years (1869-73) it visited the whole of Europe. The disease attained such grave proportions that the Austro-Hungarian Government thought fit to invite another conference on the subject, and the invitation was responded to by all the European States. This Conference, which was chiefly composed of medical men, inquired into and examined the scheme of the Conference of 1866 to shut out cholera from Europe by quarantine establishments along various routes by which the disease might travel westwards and northwards from the Red Sea and the Caspian. This plan attempted to shut up the great thoroughfares of traffic from India through Egypt, from Bagdad through Arabia into Egypt, from India into Mesopotamia, and from Persia into Turkey in Asia and Russia. This plan was submitted to a thorough discussion at several meetings; but in the end were altogether rejected as impracticable and useless. With the exception of the measures in the Red Sea and Egypt, to which some success was attributed in keeping off the disease from Europe, all other measures were considered to have completely failed. The quarantine measures enforced by the Mediterranean Powers with unusual stringency were especially notorious in prejudicing the trade of various nations without lessening in the slightest degree the ravages of the disease. The cause of failure of these measures was attributed to the fact that it did not provide against the entrance of the disease by land. It was not to be expected that nations whose trade was crippled by such a system would patiently submit, and Russia, whose trade in the Black Sea was virtually at the mercy of the quarantine agents of the Porte who held the Bosphorus, moved the Austrian and other Powers to summon a Conference to revise the conclusions of 1866, and the Conference of 1874 was the result of this application.

In dealing with theories of contagion, I have already alluded to the opinions of this Conference on the transmissibility, period of incubation and communicability of the disease by infected goods. Here we are especially concerned with the second section of the programme which relates to questions of quarantine against cholera. There was a good deal of discussion on the subject of land quarantines. The following Resolution was at length adopted by a majority of thirteen against four :—

"Considering that the organization of land quarantines is "impracticable and consequently useless, from the numerous and "daily increasing means of communication, considering also their

"establishment gravely injures commerce, it is proposed to answer "in the negative whether land quarantine should be adopted against "cholera."

The Committee that was entrusted with the drawing up of a Report embodying its opinions on the subject of maritime quarantine, submitted to the consideration of the Conference that "maritime quarantines are useless except at those ports "which are the principal points of irruption in the seaward course "of cholera," and that maritime quarantines in European ports once the disease had broken out in Europe were useless, as the uninterrupted land communications destroyed their value. These conclusions of the special committee were approved by the general body of the Conference. The Conference also recommended that the quarantine measures in the Red Sea and the Caspian were to be carried out with the strictest conformity to acknowledged hygienic principles. The Conference suggested the general adoption by all States of the system of medical inspection combined with isolation, which was then practised by some States, notably and not without success by England. Those States however which preferred to stick to quarantine were recommended a less onerous system. The following are the chief points deserving to be mentioned in the amended system of quarantine :—

1. A ship on arrival from an infected port should be submitted to a seven full days observation.
2. Suspected ships; if no case of cholera has occurred on board, a quarantine of observation lasting from three to seven days after medical inspection to be observed. The duration of quarantine might be reduced to twenty-four hours if the voyage had lasted more than seven days. In this class of cases quarantine might be observed on board.
3. Infected ships; if any case of cholera or contagious disease occurred during the voyage, the healthy should be subjected to a quarantine of observation lasting seven full days after isolation in a lazaret, the sick to be landed and treated in an isolated hospital set apart for the purpose, the cargo to be unladen and subjected to processes of disinfection.

The arguments which led the Conference of 1874 to condemn quarantine and recommend medical inspection were based not on theory, the discussions mainly turning on the practicability of imposing quarantine. The States that voted for quarantine freely admitted that there were conditions of commerce and communication both by land and sea that frustrated quarantine operations. It is especially important to note in this connexion

the difference of expression used ; while it recommended medical inspection, it only suggested a revised system of quarantine for such States as were unwilling to adopt medical inspection.

According to the Report of the German epidemic of 1873 edited by Dr. Hirsch, one of its prominent members, the German Imperial Commission, after a critical inquiry, altogether condemned quarantine as a prophylactic measure against cholera. The opinions of German medical experts were unanimous in condemning quarantine on the ground that while it interfered with the happiness, convenience and existence of a people, it totally failed in affording even the slightest security from further diffusion of the disease.

During the years 1877 and 1878 there were limited outbreaks of cholera in the Hedjaz and in Morocco. The measures levied by the Egyptian Government have often been put forward by the advocates of quarantine as an example of successful quarantine, the supposed efficacy of the Egyptian measures in guarding the shores of the Mediterranean on this occasion being taken as an argument in their favour. But the origin of the outbreak at Morocco, which closely fell in point of time with the outbreak in the Hedjaz, must be regarded in forming an opinion as to the efficacy of the quarantine measures just referred to. There are some doubts as to the true nature of the outbreak at Morocco, but whichever view we take the conclusion is fatal to the reputation of quarantine. We may put it in a dilemma. If the outbreak at Morocco took its origin from that at Mecca quarantine failed ; if it was of spontaneous origin, quarantine at Suez was of no avail ; in either case quarantine was useless.

The recommendations of the Conference of 1866 as to quarantine in the Red Sea were executed by the Egyptian and the Ottoman Governments and stand to the present day, the Conference of 1874 having confirmed these measures with its approval. The great difficulties in its administration and the losses and vexatious delays which shipowners, chiefly British, have met since the institution of the Red Sea quarantine led the British Government to take action in the matter and call upon the Egyptian Government to interfere. The administration of quarantine in the Red Sea had been entrusted to a body called the International Sanitary Council, composed of natives, medical men and others, the delegates of the Foreign Consulates in Egypt, the physicians of the English and French Consulates being allowed to advise, but had not the privilege of voting. Before the opening of the Suez Canal, ships coming from Turkish and other ports were obliged to land their pilgrims at the Mediter-

ranean ports and leave them to find out the best way they could to the Hedjaz, generally across Lower Egypt. After the opening of the Suez Canal, pilgrim traffic was facilitated by shipowners being able to book their passengers from any port in the Mediterranean direct to the Hedjaz ports. The Egyptian Government perceived the great advantages which would accrue to the country by putting a stop to the continuous and impending dangers of epidemic in that country caused by the multitudes of returning pilgrims through that country, and therefore prevented pilgrim-carrying vessels to book returning pilgrims for Suez, these being henceforth required to cross the Canal, and land their passengers beyond it. This step naturally irritated private shipowners, and complaints continually poured in at the Foreign Office. But this being considered a private grievance, Lord Salisbury, Minister for Foreign Affairs at the time, declined to take any active measures, but simply called on the Local Government Board to Report on the administration of quarantine in the Red Sea.

Dr. Radcliffe's memorandum issued under the direction of the Local Government Board severely criticizes the administration of quarantine in the Red Sea by the International Council, and finds in this another example of how little guarantee against dangers of infection by contagious diseases is afforded even by a quarantine that materially interferes with the comfort and vital interests of the human family. Dr. Radcliffe is of opinion that the time has not arrived to institute a sanitary service in the Hedjaz which could teach the people of that semi-barbarous nation that an improvement of their sanitary conditions would be of incalculable advantage in diminishing the number of epidemics of cholera and plague in that country. The author of the memorandum suggests instead of quarantine the regulation of pilgrimages and the immediate control of cases of communicable disease arising in the Red Sea as a temporary measure until the possibility of organizing a complete sanitary service in the Hedjaz. Dr. Radcliffe has also a good deal to say on the constitution of the International Council. Each delegate had a single vote, whether he represented a small nation whose interests in the Canal were perhaps confined to a few ships passing annually through the Canal or the British nation whose commercial relations with her Indian colony were immense.

To such an unequal body was entrusted the watching of Europe against invasions of cholera, and it was not a matter for surprise that the routine action of this body, based on theoretical ideas as to the efficacy of quarantine, should have given rise to measures which only served to harass the interests of commerce.

This state of affairs reached a culminating point when in 1882 quarantine was enforced at Suez on all ships coming from India, thus considerably crippling British commerce with India and causing heavy losses to English shipowners and importers. What was before a private grievance, limited to a particular class, was converted into a national question, and Lord Granville immediately informed the Egyptian Government that Her Majesty's Government are "not prepared to acquiesce in the possible "recurrence of such arbitrary and capricious acts of the Interna- "tional Board of Health as have of late caused such enormous "losses to British shipping; that they can no longer consent "that an irresponsible body should have the power of making "unreasonable laws which disturb the whole Eastern trade of "Great Britain and uselessly impede her communications with "India." In the same despatch the Khedive was called upon to remedy this state of affairs and to compile a sanitary code to be strictly carried out after approval of all Governments.

According to Dr. Radcliffe, the Government of India was not altogether without blame in the matter. We quote Dr. Radcliffe's words: "The Government of India has never attained that pitch of "administrative clear-sightedness to comprehend that quarantine "is a question for foreign nations to discuss who have faith in the "measure not for India, except in relation to their regulations and "particularly the Egyptian regulations. But notwithstanding "this, it has officially flaunted its belief against the transmissibility "of cholera, thus traversing the faith of the European schools "and pouring contempt on the doctrine of quarantine. It has "given no heed to the tenacity of belief entertained on the subject "in many quarters and has been much more concerned in main- "taining its opinions than in studying a complicated question."

Notwithstanding the recommendations of the Sanitary Conference of 1874 to the European States to adopt the improved system of medical inspection as well as to improve their sanitary condition, during the last visitation the traditional faith in quarantine was too strong for them, so that France and Spain and even Italy, which country had at length assented to the conclusion of the majority, could not resist the temptation of reverting to a measure which the better sense of the majority of the Conference had condemned. The lesson which the result of these measures has taught these erring States cannot have served in the least to strengthen their confidence in land quarantine, for at a recent meeting of the Technical Commission of the Conference assembled last month * at Rome all the members but one readily voted against land quarantine.

* May 1885.

When the disease first appeared in Toulon, desperate attempts were made immediately to institute a cordon. But so great was the panic at the time that the inhabitants began to flee in every direction to escape being shut up in the town with the cholera-stricken. No sooner the disease appeared at Marseilles then all idea of the cordon was given up.

The influence of the Italian delegate was not powerful enough to persuade his countrymen as to the fallacy that lurked under the general belief of the efficacy and the uselessness of such measures. The Italian press violently clamoured for restrictive measures, and, in response to this public appeal, both land and maritime quarantine were organized in the country: the land quarantine was intended to protect the Franco-Italian boundary and quarantine establishments were also instituted in the chief seaports. The land quarantine was maintained at great expense, a large number of troops being engaged to enforce it. Lazarets were established for the residence of intending travellers while fulfilling their term of quarantine. If land quarantine is of any advantage in preventing the importation of epidemic disease, such a quarantine, maintained at enormous expense and with all the means at the disposal of a first class European State, ought to have been attended with some success. To all the advantages mentioned above must be added the geographical position of the country, its mountainous character and the paucity of roads over which a strict supervision could be maintained not with much difficulty. But in spite of all these vigorous measures, cholera traversed the Alps in less than six weeks.

Before passing from the present subject it may not be out of place to allude to one or two evils arising from the practical working of quarantine, which were strikingly exhibited in the south of France and in Italy during the epidemic of 1884. No sooner were orders issued by the authorities for the establishment of quarantine and troops hurried from all sides to surround the infected cities then a panic generally took possession of all the inhabitants. These fled in every direction to escape being shut up in an infected town. The railway stations were crowded at all times of the day, and some even escaped to the mountains carrying with them the little they could. Such a general flight was only calculated to spread the disease far and wide, and even before the sanitary cordon was fully established, frustrate the little good that is vainly hoped from such measures by the advocates of quarantine. The utter ignorance of the masses on subjects relating to cholera on the Continent is well exemplified by the conduct of the Madridians the other day

when an official declaration of the presence of cholera in the town, eight fatal cases having been recorded in it, gave rise to a serious riot which rendered it necessary to call in the assistance of the military to disperse the riotous tradesmen. Another fact well demonstrated by this epidemic is the false sense of security that faith in the value of quarantine engendered and the consequent neglect of other means.

Most of the cities of Southern Europe, Naples being one of the most striking examples, altogether neglected the most ordinary precautions of health, and when cholera visited them, like the foolish virgins they were totally unprepared to meet the evil and sought to atone for their past neglect, quieting their consciences by false restrictive measures, while the filthy and dirty condition of the cities afforded the fittest media for the reception and multiplication of the poison.

We in India owe it greatly to the utter unbelief of the heads of the sanitary department in the value of quarantine, that all our resources and efforts are directed towards the improvement of local sanitary conditions. There are however great difficulties in the accomplishment of a work among a people slow to understand the importance and recognize the benefits of sanitation and with customs and religious prejudices to contend against.

The question whether the latest Egyptian epidemic was due to importation or was of spontaneous origin in the country itself is intimately connected with quarantine, for if it can be proved that the Egyptian epidemic arose spontaneously or exists endemically in the country, such a conclusion involves the uselessness of the quarantine measures in the Red Sea, and secondarily of quarantine measures in general. Dr. Hunter (now Sir Guyer Hunter), the British Commissioner who was sent to Egypt to inquire into the origin of the epidemic, came to the conclusion that "cholera has "existed in an endemic form since the epidemic of 1865 and pro- "bably anterior to that period." The epidemic of 1883 was consequently the outcome of the disease which already before existed in the country. The editor of the *Practitioner* criticizes Dr. Hunter's conclusion in the March number of 1884, and lays down as his opinion, after a discussion of the facts in evidence contained in Dr. Hunter's report, that "we cannot regard the question whe- "ther cholera has or has not been endemic in Egypt as one which "is by any means settled. The report appears to us to have been "prepared under the influence of a very strong antecedent personal "bias in favour of the views which it has ended in formulating- "views which do not seem to have been at all modified by the very

"imperfect nature of the only evidence which could be procured "or by the total absence of any scientific experiments."

Dr. Simpson, in the *Practitioner*, May 1884, examined into the history of the cases that were generally brought forward as evidence in favour of the importation of the disease from India and arrived at the conclusion that these cases when thoroughly sifted could not support the importation theory. This conclusion however does not exclude the possibility of the contagion having been imported by other persons. During his observations at Damietta Dr. Simpson remarked that several of the deaths occurred among devout and religious people, which gives some colour to the suspicion that the disease was introduced by the returning pilgrims in December 1882.

In the same paper, referring to the preventive measures of the Egyptian Government, Dr. Simpson remarks that "quarantines, cordons sanitaires, and other similar devices are abused. "Except at the time of terror, they are only partially carried out "and nothing after all is beyond a bribe."

Besides the cardinal questions of the etiological and pathological characters of cholera, the German Cholera Commission of 1884 was directed by its Government to enquire into the efficacy of the quarantine measures of Egypt as well as into the evidence in favour of the theory of cholera importation by returning pilgrims from Mecca. During their stay at Alexandria and Damietta they received information that cholera had broken out at Mecca and that quarantine had been enforced at Tor on returning pilgrims from Jeddah. They therefore visited Tor and Elwedj, but being prevented by quarantine regulations to proceed to Jeddah and thence to India, returned to Suez inspecting for the second time the quarantine station at Tor. During their first visit a steamer had arrived carrying five hundred passengers who were reported healthy by the medical officer, but on landing several pilgrims were found to be suffering and were therefore confined in a lazaret. On their return from Jeddah a second vessel arrived which was reported healthy, but on landing cholera had already broken out in the camp.

The abovementioned facts point to the difficulties or the laxity with which the administration of quarantine was carried on; whether these were due to the ignorance or carelessness of the medical staff at Tor. A full report of quarantine administration in the Red Sea has not yet appeared, although its publication was to follow on the earlier reports already issued by the German Commission in 1884.

In the last Sanitary Conference assembled at Rome all the members except Turkey voted against land quarantine. At the meeting of the 31st May last, Drs. Brouardel and Proust, the French delegates, laid out a programme of quarantine administration in the Red Sea, which, according to the *Times'* Correspondent at Rome "appeared unobtrusively in the middle of a "number of incidental proposals." This programme was strongly supported by the Italian and German delegates, as well as the Italian press—a circumstance which gives some colour to the suspicion that the plan was a preconcerted one, and that it was also prompted by jealousy towards British commerce. Only the English and Indian delegates voted against the proposition, so that the counter-amendments put forward by Sir Joseph Fayrer and Sir Guyer Hunter fell to the ground. Dr. Brouardel's proposal was to the following effect :—"That ships from infected "ports beyond the Straits of Babelmandeb be subjected to a "medical inspection in the Red Sea, and in the event of there "being any signs of cholera on board, be subjected to a "quarantine of five days duration, which could be prolonged if "the medical officer thought it necessary, the sick being sent "into hospital and the healthy passengers and crew placed in a "lazaretto."

The British and Indian delegates (Sir Guyer Hunter and Sir Joseph Fayrer, and Drs. Lewis and Thorne strenuously opposed the proposition, but little succeeded in convincing the other representatives, who, it appeared, were determined to establish a rigorous quarantine of unlimited duration at Suez. The Spanish delegate went even so far as to propose that a rigorous quarantine of ten days should be observed at Suez, and ten days for every additional case of cholera that appeared. Even such an astounding proposal that threatened to subject British shipping to endless delays was not looked with disfavour by the delegates of the Continental States. The arguments of the British and Indian delegates against Dr. Brouardel's proposal may be briefly summarized, as they contain the latest objections against quarantine in general but especially against quarantine at Suez :—

I. That no undoubted instance of a vessel sailing from India having caused an outbreak can be brought forward.

II. That although free communication between Australia and India is uninterrupted, no outbreak has ever occurred in that colony.

III. England never believed in the efficacy of quarantine as a prophylactic measure, and that systems of quarantine are based on traditional belief rather than on well ascertained facts.

IV. If the importation theory of cholera be correct, cholera is oftener carried across the eastern frontier than by the Red Sea route.

V. That we are not justified on humanitarian grounds to deposit cholera cases among the tribes bordering on the Red Sea.

VI. That the wiser plan would be to allow infected ships to continue their journey without detention. In the case of H. M. S. "Crocodile" cholera broke out, there being nine cases and six deaths during the voyage; but the disease had disappeared before she reached her destination. The mortality would undoubtedly have indefinitely multiplied if the vessel had been detained at Suez and the crew and passengers sent to a lazaret.

VII. That the statement of the French delegate to the effect that the conditions of quarantine as set forth in the proposition before the meeting could not be made applicable to more than two or three ships annually was far from accurate, as it did not take into account the circumstance that every Indian port was considered infected, and the medical officer would have it in his power to cause any amount of detention to Indian ships on the most trivial grounds.

The English representatives proposed as an amendment that there should be no medical inspection in the case of ships that had not had any communication with the shore, whether they were troopships, merchant vessels, or postal steamers.

Sir Joseph Fayrer in seconding Dr. Hunter's amendment said that if the Conference desired it full information of the state of health on board after leaving port and during the voyage would be presented to the sanitary authorities at Suez, who could telegraph the existence of cholera on board to any port that might be unwilling to receive her, if no obstacles were placed to the rapid voyage of vessels.

The value of a remedy greatly depends on the facility with which it is applicable, and as all remedies are evils of themselves, the mischief they work on other organs which it is not intended by the physician to affect must not be greater than the primary

beneficial effects of the drug. Whatever be our opinion as to the value of quarantine measures as preventives against cholera, one thing is certain that quarantine produces incalculable losses to commerce and this in itself is a valid objection against quarantines. Until now as I have only alluded in general to the losses to commerce resulting from the application of quarantine, it may not be out of place to say something on this subject. That the losses and vexations from the detention of individuals and the subjection of merchandise to processes of disinfection are great, nobody will deny; but they are nothing compared with those sustained by artificial restrictions of commercial relations between countries. When restrictive measures are put in force against any country, the export trade of this country with the rest of the world is suddenly cut off. The amount of misery and distress which ensues depends on various circumstances as the duration of the measures, on the magnitude of relations with other countries, as also on the number of commercial towns. If the quarantine lasts long enough, many trades are altogether annihilated, and as it is almost impossible for persons accustomed to one trade to learn another and acquire the same skill in another during a lifetime, crowds of artisans and labourers are ruined for life and thus the country impoverished. This picture may seem overdrawn; but quarantine pushed on long enough must lead to this state of things. Although cholera epidemics must cause desolation among the inhabitants and thus diminish commercial transactions it is not to be imagined that in a large town like Bombay, trade would be altogether stopped. Unless the epidemic were serious and large numbers carried off by the disease, there would always be competent men to take their place, for we must live before we die, in these hard days when life is a real struggle for existence. Even the Madrid tradesmen were wise enough to know that they would be no gainers by having cholera amongst them; but its presence must be acknowledged all the same, lest the disease assert itself in spite of themselves.

Not only the country placed under quarantine suffers, but also other countries that have commercial relations with it, for as it is one first principle of economic science that the advantages derived from commerce are mutual, the baneful effects of its sudden arrest must be more widely felt than in the country whose communication with the rest of the world was cut off by quarantine. In proportion as civilization increases, do our wants, physical and moral, and these are supplied by the ever-increasing trade of the world. Taking India, for example, to be placed

under quarantine, not only does India suffer but also England and other nations whose goods are marketable in this country. This view of the case makes quarantine responsible for a derangement of the commercial relations of the great human family—relations which under the conditions of modern society are indispensable to the existence of the community.

The Conference of 1886 was led away to an opposite conclusion, that the harm done to commerce by quarantine was in no way comparable to that caused by epidemics, by the assumption of premises which remained to be proved, and which have now been proved by experience to be utterly false. These were (1.) that restrictive measures do effectually prevent cholera (2.) That cholera may ravage a country in spite of all hygienic measures. This question, which, properly speaking, comes within the province of economists, was decided without the aid of comparative statistics and rested on the irresponsible authority of a few competent merchants whose opinions had been asked on the subject. Dr. Goodeve one of the British delegates, who abstained from voting, pointed out that the Commitee had exaggerated the losses caused by restrictive measures, while those caused by epidemics were lightly passed over. He himself thought the difference depended on many circumstances; for instance, the extent of commercial relations and the duration of restrictive measures. In cities like London or Paris commerce would not be much affected by an epidemic, whilst a quarantine of some duration would certainly hamper its trade. Now that experience has abundantly shown that land quarantines are impracticable and useless and Dr. Cunningham's reports satisfactorily proved the value of hygienic measures in lessening mortality from cholera, it is unnecessary to discuss at length the conclusion of the Conference or collect statistics; for it is folly indeed not to be content with the ravages caused by the disease that we must go and seek for artificial means of our own making to still further precipitate our commerce and make our ruin complete.

As restrictive measures bear most heavily on the nations that have the greatest commercial interest in the country placed under quarantine, it happens that quarantine in the Red Sea, which practically places India and the East in quarantine by sea, inflicts heavy losses on British shipping and trade. The quarantine system operates very unequally and the whole burden of delivering Europe from cholera falls on England's shoulders. That the inconveniences felt by British shipping crossing the Canal—a subject I have already referred to—are no empty threats, but real

grievances, is confirmed by the action taken at the recent meeting held in London by the representatives of the principal Eastern steamship lines. They resolved to amend their bills of lading that English vessels from infected ports might be at liberty to chose the Cape route. They considered that if the new quarantine regulations passed by the Roman Conference were enforced at Suez, any advantages the Suez Canal route possessed over the Cape would be more than counterbalanced by the unlimited delay in addition to the heavy transit charges. Whatever be the motives of the Continental delegates in seeking to establish a rigorous and unlimited quarantine, whether it be jealousy or mistaken humanity, it must be a matter for regret that the administrative follies of quarantine have reached such a pitch as to compel a nation to abandon the new channel of communication between Europe and Asia, one of the greatest works of our age and revert to the old Cape route.

I now pass over to the consideration of plague in relation to quarantine. The earliest notice of plague is found in a work of Oribasius, physician to the Emperor Julian (A D 361-363). It is here described as an endemic originating in Egypt where it is said by him to have existed from the second or third century before Christ. The disease broke out by a violent explosion in Egypt in the sixth century, and rapidly extended to the neighbouring countries of Asia and Africa. From that period it has existed more or less with varying severity until 1844, when the disease totally disappeared from Europe and one secular evolution of the disease seems to have been completed.

One of the most remarkable phenomena presented by the history of plague since the 17th century is the progressive contraction of the area of prevalence of the disease which it exhibited until its ultimate extinction after the fourth decade of the present century.

In the fifteenth century the disease was present in North Africa, Egypt, Western Arabia, Palestine, Syria, Asia Minor and Mesopotamia, Persia, India, China and the whole of Europe. During the later half of the 17th century and the whole of the 18th century a rapid decline of the disease was observed. With regard to Europe, in the space of twenty years (1661-1681) plague had disappeared from Italy, England, Western Germany, Switzerland, Netherlands and Spain. At the commencement of the 19th century the disease was confined to the eastern corner of Turkey in Europe, and in 1841 altogether disappeared from Europe. Meanwhile plague was disappearing from North Africa (except

Egypt) Mesopotamia and Persia. In 1844 the disease was no longer seen in Egypt, which secured for Europe a deliverance from the terrors which had for so long a time beset every country of Europe.

In the 16th century 69 outbreaks of the disease were recorded in Europe, of which five took place in England ; in the 17th century, 56, six in England ; in the 18th century, 28 (none in England) and in the first half of the 19th century 15. This statement shows a gradual diminution in the number of outbreaks, although no abatement of the severity of the disease was noticed, the later outbreaks of the disease being as fatal as the earlier ones.

The dependence of plague on contagion is satisfactorily established. The evidence in favour of the contagious character of plague is becoming stronger day by day. Of the medical officers of the French and English armies who have visited Egypt from 1709 to 1812 and published an account of the diseases observed during the campaign, only one of them Assalini came to the conclusion that plague is not contagious. Of the Select Committee that was appointed by the House of Commons to consider the validity of the doctrine of contagion, all the medical men except two, Drs. Maclean and Mitchell, were in favour of the generally received doctrine.

The appointment by the French Academy of the Commission to enquire into the nature of plague, the conditions required for its dissemination and development marks an epoch in the history of this malady. The Commission was composed of scientific men, whose learning and fame were sufficient guarantee of their fitness for the task. They examined masses of correspondence and a number of witnesses who had some personal experience of the disease.

The result of their labours were presented to the Academy, and after discussion in that body, was published in a report edited by Dr. Prus. This document is one of the most valuable we possess on the subject of plague, and represents our present knowledge of the subject. The main difficulty the Commission had to contend with was that the majority of the members were personally unfamiliar with the disease, and a large proportion of evidence was not direct but based rather on traditional acceptation than on personal scientific observation, especially as the opportunities for observing the disease become rarer as our knowledge of pathological phenomena increased. As to the origin of plague and the conditions "which determined and favoured" its development among

communities, they were chiefly attributable to a neglect of the laws of health; habitation on alluvial and marshy soils as on the shores of the Mediterranean, banks of the Nile, Danube and Euphrates; warm and humid atmospheres; low, badly ventilated and crowded houses; animal and vegetable putrefaction.

The recent outbreaks generally occurred after famine and drought when most of the crops had failed and fatal epizootics prevailed amongst the flocks and herds. This was especially the case in the outbreaks at Bengazi (1858-59) and in Persian Kurdistan (1863). In the latter district an additional cause of disease has been noticed in the circumstance that just before the outbreak a large number of cattle had died from murrain and these were left unburied to poison the air with their putrid emanations. According to Drs. Colvill and Cabiadis poverty was the most potent cause in promoting plague in Bagdad and other Mesopotamian towns so that the latter styles the disease *miseriae morbus*.

The conclusions of the Commitee with regard to the propagation and transmissibility of the disease show that, while the disease can pass from the sick to the healthy, the general belief that the slightest contact with the sick or with such articles as have been exposed to the influence of the poison is sufficient to cause infection, is not at all justified by facts: on the contrary all the evidence before the Commission went to prove that the local conditions around the patient mainly determined whether an individual in communication with the sick would catch the disease or not: that these chances of infection increased in proportion to the degree of confinement and diminished with the freedom of ventilation in the apartment: that under these circumstances only could those affected with the disease form centres of infection: that the infection was carried through the air and might be communicated to places and bedding and other articles on which the patient had lain.

The predisposing causes of plague were found to be the same as those of specific fevers: poverty, famine, bodily weakness and insanitary condition had a decided effect in determining the severity of the case.

As to the practical question of quarantine, the Commission was of opinion that the conclusions arrived at, with regard to the origin and communicability of the disease, did not give the same support to quarantine as the old theories handed down by tradition. There was a good deal of discussion about the practical question of quarantine at the general meeting of the Academy, which showed, without in any way weakening the conclu-

sions of the Commission, the difficulty of arriving at an unanimous opinion as to what measures to adopt to prevent an extension of the disease.

These were in short the opinions of the Academical Commission on the origin, transmissibility, and prevention of the disease, and our recent experience has on the whole served to confirm them.

After 1844, most epidemiologists considered that the disease had become extinct, a view which was not shared by all and notably by Gavin Milroy who, considering the long period that generally elapsed between succeeding outbreaks in former appearances of the disease, truly prophesied its reappearance, and since 1844 a number of circumscribed outbreaks have arisen in Western Asia, North Africa, Mesopotamia, Persia (Kurdistan) and the Hedjaz. These outbreaks took place in localities difficult of access and among semibarbarous tribes; but, notwithstanding these dangers and difficulties, there have not been wanting self-sacrificing men who have braved all the dangers of such undertakings, and brought us valuable information from the scene of the outbreak. Our chief authorities on this part of the subject are Drs. Arnaud, Castaldi and Cabiadis of the Ottoman Medico-Sanitary Service, and Surgeon Major Colvill of the British Residency, Bagdad.

Before entering on the description of these localized outbreaks, we have to consider what influence the resolutions of the Academical Commission had in modifying the rigor of the quarantine laws as enforced against plague. The resolutions had little influence in modifying quarantine legislation, and the quarantine laws remained unaltered, except perhaps in the Levant, where the restrictions became so far modified as to render them applicable to infected ships only or ships from actually infected ports. The Committee of the Sanitary Conference of 1851 had its faith in quarantine not in any way shaken by the conclusions of the Academical Commission, for in its report on the organisation of the service in the Levant, it remarks on the Ottoman quarantines thus: "But it is as well to remark that the plague has "disappeared not all at once but by degrees and in proportion "as the Ottoman quarantines extend their sphere of "action, and the disease consolidates itself more and more can they "act with more energy." The quarantine referred here was established in 1838 and by 1844 plague had ceased in the Ottoman Empire and Egypt, and this marvellous effect was attributed by the Conference of 1851 to the rigid enforcement of quarantine. Since 1851 there has been a gradual relaxation of

the severity of the quarantine regulations with regard to plague by several of the Mediterranean Powers, the last instance being the revised measures adopted by Egypt in 1878.

Since the deceptive cessation of plague in 1844 eight appearances of the disease have been recorded.

I and II.—In Western Arabia, in the Assyr district, in 1853 and again in 1873-74.

III and IV.—In the province of Bengazi, Tripoli, in 1858-59 and 1873-74.

V and VI.—In Persian Kurdistan in 1863, and again in 1871.

VII and VIII.—In Mesopotamia in 1867, and again in 1873-77.

It is unnecessary to enter into a geographical and topographical description of the sites of these outbreaks, which are found in the works of Arnaud and Castaldi and wellknown reports of Surgeon Major Colvill published in Parliamentary Papers of 1879 under the title of "Report of the Levantine Plague." These valuable documents enter into full descriptions of the orgin of the outbreak, the symptoms and fatality of the disease, as also of the restrictive measures taken by the Ottoman Government to check the disease. As there is a certain degree of monotony and repetition in the everlasting cordons and quarantines that were enforced on these occasions without regard to circumstances of time and place, it will be unprofitable to put in an account of these, as I propose giving a somewhat fuller account of the quarantine measures in Astrakan in 1879, dictated by the Russian Government at a time when it would be naturally expected all human measures would be taken to protect Russia and the whole of Europe from a second periodical visitation of the disease.

Dr. Tholazan makes a very instructive comparison between the course of epidemics in countries where regular sanitary services were instituted, as in the African and Mesopotamian epidemics, with that in countries as the Assyr district and the Hedjaz, where the ignorance and fanaticism of the populace are opposed to the introduction of any restrictive measures, or in Persia where no sanitary administration exists. The advocates of quarantine would not risk the reputation of quarantine on the nominal measures that go by the name of quarantine in the Hedjaz. These refer to a detention at Jeddah or other seaport on the Red Sea. It has never been considered prudent to institute sanitary cordons round infected

districts in the Hedjaz, and therefore quarantine cannot be correctly said to have been tried in the Hedjaz; and as hygienic measures are out of the question, the natural course of the disease can best be illustrated by the course of the disease in that province. The quarantine measures on the occasion of the several outbreaks in Mesopotamia and North Africa were framed on a more rigorous and completer system; but even these cannot be considered as perfect, for a perfect system can only exist in the minds of enthusiastic devotees of quarantine, but is a practical impossibility. The measures taken in Africa and Mesopotamia are fair samples of what quarantines commonly are, and if the friends of quarantine cannot exhibit better specimens, quarantine must be judged on the merits or demerits of these, and it cannot be considered unfair to quarantine to draw conclusion as to its value from practical examples.

At Bengazi in North Africa in 1858 ninety-five deaths from plague were registered in the month of May, and five hundred and forty-two in June, yet quarantine was not practised against arrivals from this port until the 15th June by Egypt and the 23rd of June by Constantinople; so that supposing the disease to have commenced in May, although there is every reason to believe the disease commenced in 1856, the disease remained unchecked for a full month and a half, during which period it had ample opportunities, if there were such a tendency in the disease, to extend in all directions.

In Tripoli, although in such close proximity to Malta and Crete, plague remained unnoticed from October 1873 to May 1874, during which period no measures of quarantine were taken either by the local authorities or by the States in maritime communication.

The same was the case with the epidemics of plague in Mesopotamia in 1867, 1874-77.

The outbreak of 1867 was not known in Bagdad, a distance of two or three days journey from the scene of the outbreak till four months after its commencement.

The plague of Dagara and Affy (1874) was not heard of in Bagdad until the 11th of April. A similar delay took place in the third epidemic that occurred in Mesopotamia (1875-77).

These facts inevitably lead us to the conclusions so ably discussed and arrived at by Dr. Tholazan in his "La Peste en Turquie dans Le Temps Modernes, sa prophylaxie defecteuse, sa Limitation spontanee—Paris Masson—1880.

1. That the sanitary systems followed were too imperfect, tardy and insufficient to justify us in attributing to them any influence in limiting the spread of the disease.
2. If the outbreaks had been influenced by the measures, they would have diminished or terminated at different periods in the course of the epidemic according to their strength.
3. Observation on the contrary demonstrates that the course of the disease is uniform : it arises at one or more points, reaches its acme and terminates at certain epochs, periodicity being one of its marked characters.
4. The outbreaks in the Assyr District and Persia were not severer in character or of longer duration or differ materially in their course from those in Mesopotamia and Africa whence the inefficacy of the quarantine measures in the latter countries may be concluded.
5. The natural history and geographical pathology of these epidemics indicate that they have all sprung independently of each other, have invaded a certain locality, generally the same as at preceding outbreaks, have pursued a definite course, and been limited to the locality of its origin.

The independent reports of the several physicians, whose information was acquired in different outbreaks in all phases of the disease and under varying circumstances, all unanimously tend to confirm the conclusions of the French Academy on the most important subject of the transmissibility of the disease. Actual contact is not alone sufficient to propagate the disease, and the chances of infection depend on the conditions in which the patient is placed : if free ventilation is maintained the chances of contagion are minimised, under opposite conditions the infecting power can even act at some distance from the patients, the vitiated atmosphere around acting as a medium of infection by the healthy breathing the tainted atmosphere. The liability to contagion is however increased in those whose duties bring them in association and constant attendance on the sick. Inmates of the same house especially suffer as is so clearly demonstrated by the epidemic in the province of Astrakan. Attendants and nurses suffer more than physicians and surgeons whose visits are less frequent.

The theory as to the possibility of infection being carried by articles and merchandize is one on which the system of quarantine is founded, and therefore especially important in connexion with the present question. Instances numerous have been recorded, says Dr. Cabiadis in his description of the Mesopotamian outbreaks

of 1876 and 1877, in which there was every reason to believe that contagion was carried by means of bedding and clothing recently used by the sick but not a single atom of evidence can be brought forward in support of the theory that articles of merchandize can serve as media to carry the contagium—a theory on the strength of which what are considered dangerous and susceptible goods are subjected to quarantine regulations and processes of disinfection.

Our present knowledge on the subject of transmissibility of plague, resting on the authority of the learned French Commission and confirmed in a remarkable manner by independent and trustworthy witnesses, points to a close similarity between the habits of this disease and typhus, a disease which has not been found worthy of the honour of being quarantined in practice although it is included among the contagious diseases of the English Quarantine Act.

An important corollary based on analogy may be deduced from the striking similarity between typhus and plague in the manner both diseases are propagated: that if legislation does not consider it necessary to wield the clumsy and ineffective machinery of quarantine against typhus, there is no reason why it should adopt a different mode of procedure in the case of plague.

After an absence of thirty-seven years, since the year 1844, when the disease was totally extinguished in Egypt, one of the districts in which plague was believed to be endemic, plague reappeared in Europe in the province of Astrakan in Russia, having first broken out at Vetlianka, a Cossack settlement on the lower Volga, and extended to the adjacent districts on both banks of the River. It will not be unprofitable to enter into a somewhat detailed account of the quarantine arrangements on the occasion of the outbreak, as this was the only European outbreak since the appointment by the Academy of the Commission, whose labours in 1844 have done so much to elucidate the true nature and history of plague, and purify them from the traditional errors which had been hopelessly mixed up with them by the fears or ignorance of past ages.

The outbreak in the Volga district offered special advantages for observations regarding the natural course and prevention of the disease. While the outbreaks in Tripoli, Bengazi, Mesopotamia, Persia and Arabia occurred among semibarbarous tribes and the restrictive measures adopted by the Ottoman and other Governments were such as would perhaps not satisfy the hearts of the admirers of quarantine, in this outbreak we can watch the efforts of a first-class European State struggling by

means of quarantine and sanitary cordons to quench the evil before it burst forth into a conflagration that might rage over the whole of Europe. Commissions were ordered by different Governments to repair to the spot and procure all information they could. Such was the general alarm at the time throughout the whole of Europe lest the disease spread northwards that nearly every Government thought it necessary to quarantine Russia. Some of the nations lost their wits altogether, and went even so far as to quarantine other nations not because these nations were infected but because in their opinion the precautions taken by these Governments were deemed insufficient by their superior knowledge or because they considered their geographical position to be favourable to the spread of the disease. Turkey was placed in quarantine in the Black Sea and Sea of Azov by Greece, Egypt and Malta. Even France was compelled by several of the Mediterranean Powers to make her quarantine regulations more rigorous for Russian arrivals.

But here we are especially concerned with the measures taken by the provincial and Russian Governments which, as a matter of course, partook of quarantine. Notwithstanding that the Foreign Commissioners did not receive any assistance in the way of official information at the hands of the Russian Government except whatever information they could personally gather from some of the local physicians, we are nevertheless provided with accurate accounts of the quarantine arrangements and other restrictive measures that were intended to form an artificial barrier against the disease. Not to load the present essay with numerous examples of sanitary cordons and quarantines, I have reserved a description of the details of such measures until now; for examine whichever epidemic you will, whether in the earlier period or in the later period of rational quarantine, you find the same difficulties, the same mistakes and blunders which are inseparable from quarantine, and which no administrative skill can ever hope to overcome.

There are three theories put forward to explain the origin of plague in Astrakan. The most generally accepted view suggest the introduction of the disease from Resht, a town in Persia, where plague was known to have existed in 1877 and the earlier months of 1878. This probability is favoured by the fact that considerable trade is said to exist between this town and Vitlanka. The only objection that has been brought against this view of the importation of the disease is the immense distance between the two towns.

The second theory alleges that the disease was introduced by the Vitlanka troops returning from the campaign in the neighbourhood of Erzeroum and Kars or brought on by articles of clothing obtained from Bagdad or some part of Turkey that had been infected with plague. An objection to this theory asserts that the Army of the Caucasus must have been recruited from various parts of Southern Russia, and that it was very unlikely that returning soldiers should have carried the infection to one district alone.

A third theory has been suggested by the British Commissioners, Drs. Payne and Colvill, to explain the origin of the outbreak by the spontaneous development of miasmatic effluvia under local conditions that bore a very close analogy to those obtaining in Mesopotamia.

One of the chief characteristics observed in this outbreak was shown in the marked tendency of the disease to spread to persons attending on the sick, so that it has been described as a number of house and family epidemics, twenty-five families having been entirely extinguished. Those brought into close contact with the sick suffered in proportion to the assiduity of their attendance. A large number of priests succumbed to the disease, which was contracted in the performance of their religious duties at the bedside of the sick. Three out of four physicians died, and eight of the sanitary staff. These are indubitable facts resting on as good evidence as we can ever hope to obtain which, in a remarkable manner, go to confirm the conclusions of the Academy in 1844.

The quarantine measures adopted on the occasion of this outbreak may be divided into. 1, Measures instituted by the district authorities 2, The improved measures carried out by the orders of the Imperial Government through General Count Loris Melikoff appointed with special powers as Governor Extraordinary of the provinces of Astrakan and Saratov for the extirpation of plague.

The earlier measures by the Cossack local authorities comprehended.

1. A sanitary cordon round the entire village to protect the neighbouring villages.
2. A district cordon round a number of villages.
3. A sanitary cordon on the frontier between the province of Astrakan and Saratov.

With the arrival of Count Melikoff, the Imperial funds were

available towards sanitary measures and these were chiefly dedicated to the following purposes :—

1. The village cordons were strengthened in number, and quarantine stations established at regular distances along the principal thoroughfares.
2. The river which before had not been included in quarantine was now watched by guards and patrols.
3. A sanitary cordon was established along the whole of the western and the north-western frontier.

As regards the village cordons and other measures taken by the provincial governments, the difficulties in preserving these were manifold; not only had the authorities to deal with individuals maddened with terror and panicstricken, but in the commencement there was uncertainty in the minds of the local physicians as to the true nature of the disease, either because they had not seen such cases before or because they were unwilling to admit the existence of such a fatal disease among themselves.

The measures taken by the Imperial Government were taken with a view to protect not only Russia but the whole of Europe from the disease.

We take the account of the sanitary cordon and quarantine stations from the graphic description of the British Commissioners. The smaller cordon had been removed before their arrival, and the description therefore applies to the longer cordon.

"The first cordon of General Melikoff extended from near "Sarepta on the north to Petropauoswski on the south on both sides "of the river. On the 19th February it was decided on the report "of the Medical Commission to curtail this cordon, the northern "limit of it being the village of Graczewka. It was in fact "at this village that we first observed for ourselves the "quarantine arrangements. On approaching the village, we were "challenged by a sentry and had to show our passports. We then "drove through the main street, and found its further end shut off "by hurdles so as to include a sufficient number of houses for the "purpose of a quarantine station. We had to leave our carriages, "and were taken to an office where we were supplied with the "necessary papers. Here we observed from a distance the vedettes "outside the village composing the cordon. Considering that "the country was flat and bare, these troopers were sufficiently close "to prevent anyone crossing the line on the plain during the day-"time. But it must be remembered that this line included the "bed of the Volga for the cordon extended on both sides of the

" river and the bed of the river is about thirteen miles wide and a " great part of it full of trees, swamps and brushwood, where pre- " cautionary measures did not appear to have been taken. This " line of cavalry extended through the whole circuit and as for a " considerable portion of its extent it ran through barren steppe " country, we are told by the aide-de-camp of Count Loris " Melikoff that great difficulty and expense were involved in keep- " ing it up."

" The quarantine station itself was like the other, merely a " portion of the village street, not more than 100 or 200 yards in " length, shut off at both ends. The passages or roads which led " off from the street were closed with simple palings. Sentries " were placed at the two gates, but the sides of the enclosure seem- " ed to us less carefully guarded. At the time we arrived there were " two hundred or more persons undergoing quarantine. * * *

" No attempt was made to keep apart those who had entered " quarantine at different times and were allowed to communicate " freely. Further we should point that the head police officer and " other persons who were constantly within the quarantine limits " were not considered to be strictly in quarantine but appeared to " communicate with persons outside. * * * * * *

" A quarantine of ten days enforced on every person leaving " the district surrounded by the general cordon. A quarantine of " 42 days was enforced on all persons leaving any of the villages " and the effect of this was almost entirely to prevent the inhabi- " tants from cultivating their fields."

The Imperial German Commission adds a few more particulars about the quarantine stations which consisted of:

A. A reception house for examining papers and passports which were taken by the doctor with a pair of tongs and put into a disinfecting chamber.

B. Two buildings destined to receive plague-suspected people. One consisted of a large room for the use of ordinary people and the other of four small rooms for people of distinction.

C. Disinfecting chambers for the purification of clothes and baggage.

D. Special lazarets for the plague-stricken and those suffering from contagious diseases other than plague.

Yellow fever is another disease against which it has been considered necessary to enforce quarantine. It is the only disease that is subjected to quarantine in English ports, and this it is said

on authority not by reason of any faith in the efficacy of quarantine but as a purely international commercial question to be dealt with, not by the Local Government Board in whose hands the ordinary sanitary administration of the kingdom lies, but by the Privy Council aided by the Board of Trade. There is only one quarantine establishment in England, the Motherbank, and this is maintained for this disease.

It would be impossible here to enter into the pathology of the disease or even into a discussion of the different theories with regard to the communicability of the disease. It will be sufficient in this connexion briefly to enunciate the contrary opinions on this subject. The subject of the pathology of the disease has been discussed in several works, among others I may mention the treatise by Roche, an able paper in the *Practitioner*, August 1882, by Dr. J. Jones and in the articles contained in the standard medical treatises by Aitken, Reynolds and Flint.

One of the most characteristic features of this disease is its limitation to certain geographical boundaries in the moist and warm climates of the West Indies, Mexico, and tropical America.

The districts of Mexico and the temperate regions cannot be strictly regarded as endemic. The strictly endemic area extends northwards as far as Boston, eastwards to Lisbon, Cadiz, Barcelona and other seaports and inland towns in Spain. Density of population and elevated temperature are favourable to the origin of the disease.

One fact has been especially noticed in epidemics of this disease, that natives of hot climates where the disease is endemic are not so susceptible to the influence of the poison as strangers from colder regions and the arrival of a large number of emigrants has often been the signal for an outbreak of the disease, in which the latter suffered most, thus leading us to the supposition of the existence of an endemic cause especially acting on such individuals as have not by residence in tropical climates secured immunity from the disease. There are various opinions as to the nature of the disease and the manner in which it is propagated. Some believe that yellow-fever is a miasmatic disease, which originates itself *de novo* (or spontaneously) under favourable conditions in certain tropical climates, but that unlike remittent and intermittent fever the disease spreads by contagion.

Others maintain that yellow-fever is a specific infectious fever, and that it is directly propagated by inland communication along railroads and navigable rivers or by ships along the great channels of commerce.

A third set of observers hold that both local and general causes must cooperate for the specific virus to act on individuals or communities. A section of this class of observers have a peculiar view of the propagation of the disease; that the disease can arise *de novo* in the atmosphere of the holds of ships travelling in the seas of the yellow-fever zone; that this poisoned atmosphere may escape at seaport towns, and if at such places it meets with general insanitary conditions as in over-crowded or filthy localities, the disease may acquire an epidemic and contagious character.

This theory has evidently been started to explain two facts in the clinical history of the disease which appear to be irreconcilable with the former theories, firstly its limitation to certain geographical limits, and the occurrence of epidemics under climatic conditions of temperature and season, secondly the transference of the disease outside the endemic area through the agency of the sick while there is absence of all direct contagion from the bodies of the sick as proved by the observation that physicians, nurses, and attendants on the sick are not more affected than others.

There can however be no doubt that human intercourse, directly or indirectly, has some influence in extending the disease; for even in the endemic area the disease is commonly confined to seaport towns a little above the level of the sea, and it often spreads into the interior especially along the banks of navigable rivers. That one ship can give rise to an epidemic is well illustrated by the epidemic of yellow-fever at Swansea, which has been ably reported on by Dr. Buchanan. On the 9th of September 1865 the "Hecla" barque laden with copper ore arrived at her destination at Swansea from the West Indies. She had six cases during the voyage, three of which proved fatal, two convalescents and the remaining case (James Saunders) being sent on shore the crew left the ship and two passengers also with their baggage landed. Immediately after an outbreak of yellow-fever arose in the town and Dr. Buchanan in a table of cases was able to trace the outbreak to the cases on board.

Dr. Flint, the American physician, whose experience in this disease must be more extensive than that of European authors, and whose opinion on this subject ought therefore to be received with some respect altogether denies the multiplication and reproduction of the special cause in those affected with the disease, and that therefore yellow-fever cannot be classed under the contagious diseases as distinguished from the infectious or miasmatic diseases. Dr. Flint however lays particular stress on the portability of the infection or miasm in clothing and merchandize and

affirms that there are abundant facts to prove that the special cause can be distributed by vessels, railroads, and other methods of conveyance.

This view of the case makes an important difference between this and other miasmatic diseases as malarial, remittent and intermittent in which this property of being carried from one place to another by ships or other methods of conveyance is absent, or if present, has been too insignificant to attract the attention of observers. I have already spoken of another explanation of this character of the disease by the conveyance of poisoned atmosphere in the holds of vessels either generated there spontaneously or carried from infected localities in the endemic area.

It will be useful to summarize the reasons which have led Dr. Flint to reject the theory of direct and personal contagion with regard to cholera.

1. The disease is limited to certain geographical boundaries.
2. The rise and progress of epidemics are not consistent with its diffusion by contagion. Fenner's observations point out that in New Orleans 1853 the disease broke out independently in many places among persons who had not the slightest communication with each other, and he also failed to find during twelve years any trace of the contagious character of the disease. This is also true of other epidemics as conclusively demonstrated in an article in the *British and Foreign Medico-Chirurgical Review.* Oct. 1870.
3. The occurrence of sporadic cases in the endemic area.
4. Epidemics of yellow-fever are too rapid to spread by contagion.
5. Persons brought into contact with the sick as physicians, nurses, ward attendants do not contract the disease any sooner than others.
6. Experiments to test the contagious character of the secretions or excretions as by inoculation on animals have led to negative results.

Dr. Flint is also of opinion that the multiplication of the causative agent, probably organisms, may take place without the body and irrespective of local causes, and therefore its development in exotic climes is not an impossibility. This explanation accounts for the apparent anomaly of epidemics of miasmatic diseases occurring outside the endemic area, and does away with the necessity of resorting to the artificial explanation that poisoned atmosphere

is conveyed in the holds of ships or to the contagion theory of yellow-fever. Opinion in favour of the contagion theory is however very strong in some quarters, and Dr. Parkes in his last edition of hygiene enunciates his belief that "yellow-fever like cholera and typhoid fever is a fæcal disease."

The period of incubation of yellow fever varies from a few days to several weeks. It is therefore impossible to say how long a ship should be in quarantine before it may be considered safe. Our want of knowledge on the subject of incubation of diseases deprives those whose duty it is to frame the details of quarantine of any scientific basis for determining the duration of quarantine, one of the essential preliminaries of such systems. If the duration of quarantine is to be arbitrarily decided, such a quarantine cannot be considered to stand on a rational basis in the sense of the Conference of 1866, and every quarantine for yellow-fever ought to be condemned as unscientific until our ideas as to the duration of the incubation period are more exact.

If we accept that the disease is not contagious, a rational system would not include the detention of the persons of living or dead after disinfection of the clothes. All merchandize however would have to be disinfected before landing. Experience has shown that it is possible to exclude the disease from places even where the disease has on former occasions existed as an epidemic by a strict and rigorous quarantine, but when the disease is endemic it is of very doubtful value. This we can readily understand as quarantine in no way remedies those conditions of vegetable decomposition under the combined influences of heat and moisture that originate the specific cause, although it prevents transportation of the germs to localities where such conditions do not exist. The great inconveniences caused by, and the impracticability of, quarantine, which we have already had occasion to dwell upon, render it necessary that we should look for more effectual and simple means. The system of medical inspection is as applicable to this as to other so-called contagious diseases. The advantages gained by quarantine in epidemics of yellow-fever outside the endemic zone have not been so brilliant as to increase confidence, for in September 1874 the Government officials of the United States Government at Washington considered it expedient to lessen the rigor of the quarantine laws even with respect to this disease. They especially drew attention to the successful prevention of the disease in New Orleans, New York, Baltimore and five othr towns by the cord ial co-operation of the Medical Staff and the Customs authorities, an arrangement nearly,

analogous with the system of medical inspection now in vogue against cholera at English seaports.

Having touched upon the different theories of contagion with reference to cholera, plague and yellow-fever, the three diseases against which quarantine has been enforced and noted its failures during its trial in the present century, it remains to conclude and see how what I have already said bears on the question that constitutes the theme of this essay. Is quarantine of advantage in preventing the spread of communicable disease? It has been asserted that isolation is of immense service in preventing the spread of contagious diseases to individuals, might the application of the principle not be extended to communities with equal success. Apart from the difficulties of an extended application of isolation, there are additional forces besides contagion which come into play in the propagation of disease, in proportion as its sphere of action widens from individuals to communities. Of the three diseases only plague can be strictly classed as contagious, and to which quarantine is therefore theoretically applicable, and even with respect to this disease has it been abundantly shown that the readiness with which the disease is communicable to others depends in a great measure on the surroundings of the affected patients. Another marked character of the recent outbreaks of plague is their localization to favourite districts at certain times notwithstanding facilities for a widespread epidemic: at other times before the extinction of the disease in 1844, a determined tendency to spread from country to country was exhibited. There is a great resemblance between typhus and plague in the manner both diseases are propagated: the area of contagion in both is limited to a small space around the patient, and in typhus as well as in plague the noxious influences may be lessened by free ventilation in the apartment. In an epidemic of typhus it is considered sufficient to isolate the patient in a strictly ventilated apartment, no restrictive measures in the shape of quarantine being considered necessary to prevent its spread to other communities. It is difficult to say why quarantine is deemed requisite in a disease which is not more communicable than typhus. The successful working of isolation in diseases tike typhus depends in a great measure on the attention paid to the hygienic surroundings of the patient, while a vitiated atmosphere is calculated to carry the poison beyond the isolated chamber and frustrate the end of isolation. It follows from this that even in the simplest contagious diseases its success depends on the cooperation of hygienic measures, which must be regarded

as indispensable. If the most complete attention is paid to hygienic details, it may be possible altogether to relax the stringency of isolation, which even in the smallest of families, is attended with the greatest difficulties.

When an epidemic of typhus or a contagious disease breaks out in different quarters of a city, the common observation is that the disease makes more rapid strides in overcrowded and badly ventilated places than under opposite conditions: in such cases it is difficult to guage the relative influences of contagion on the one side or neglect of the laws of health on the other in bringing about this remarkable difference, for the filthiest localities are nearly always the most overcrowded in which isolation is out of the question, and the rapid diffusion of the disease is unchecked. But there have been circumscribed outbreaks of plague repeating themselves in the same locality, and as in none of these can we trace the importation of the disease from previously existing centres of disease, we are led to infer that the disease originated spontaneously from decomposition in the marshes produced by river inundations or the decomposition and putrefaction of cattle dead from murrain or some such impure sources that I have already mentioned as having accompanied or preceded the outbreak. If we disbelieve in the spontaneous generation of the disease, we are thrown back on the more likely supposition that the disease was the result of infection from cases of very distant date, the germs of which had lain dormant but were revivified by the combination of unhealthy influences that heralded the disease. That germs can lie dormant and retain their vitality for a long time is rendered probable by the behaviour of the organism of splenic fever which is capable of retaining its vitality for an indefinite period as "spores" which according to Dr. William Roberts "can retain their infective "activity for a very long period, in spite of all kinds of maltreat-"ment. They can be reduced to dust, wetted and dried, kept in "putrefying liquids for weeks and yet at the end of four years still "display an undiminished virulence." Whatever be the conditions necessary to rekindle latent germs of disease, or if it is possible to generate them anew, it is certain that quarantine cannot in the least affect those conditions, the intensity of which must bear a direct relation to the quantity and virulence of the poison that is made manifest. These conditions which it is evidently in the province of hygiene to ameliorate or if possible altogether to remove, act in a twofold manner in determining the severity of outbreaks of disease directly by the affecting the production of the causative agent by furnishing the necessary forces for the fresh

generation or revivification of germs in a state of hibernation: indirectly by contamination of the air and the multiplication of foci of contagion. As long as these conditions last and the germs of disease are not exhausted from the soil, fresh foci will be formed, and all our efforts to mitigate the disease by measures of isolation frustrated. Our first attention in the treatment of epidemics ought to be directed to the primary source of the disease, which can only be remedied by suitable hygienic measures. Some writers are so far convinced of the beneficial effects of ventilation and other hygienic measures that they even attribute the extinction of plague at Cairo to the levelling of some hillocks which prevented the air reaching the city, the filling up of marshes and the adoption of a better system of burial. The disappearance of the Pali plague in India has been claimed as another victory for sanitation.

There is however a class of diseases to which belong smallpox and scarlet-fever in which the areas of contagion are much wider: in the difusion of these contagion plays a much more important part at the same time that measures of the nature of isolation are more difficult of application and less successful than in typhus.

The preceding remarks tend to show that from a consideration of the habits of plague, quarantine does not attack the real source of the disease in the community; that as long as the source of the epidemic remains unchecked, it cannot be expected measures of isolation of the nature of quarantine will be of use in preserving the community; that as success in isolation depends on attention to the personal surroundings of the sick, quarantine to be successful requires the valuable cooperation of hygienic measures in the community; that in diseases like typhus and plague in which the area of contagion is not so extensive as in smallpox, measures directed towards checking the disease by contagion ought to be subordinate to those directed to remove the primary conditions of the disease: that a sanitary cordon within or on the borders of the infected locality will probably be attacked by the disease: that a sanitary cordon outside the infected area is useless as not likely to be respected by an epidemic with a tendency to burst forth in all directions under the influence of undefined meteorological changes or through the agency of the contaminated atmosphere of the infected district: that it is the opinion of some that improved ventilation of cities and other sanitary measures are sufficient without the aid of restrictive measures, to bring about the extinction of diseases like plague.

Quarantine may therefore on theoretical grounds be said to be of advantage in preventing the propagation of diseases by contagion to places where the source of the disease does not exist, provided the disease is not carried beyond the barriers of quarantine by a contaminated atmosphere or under the stronger influences of climatic changes; it cannot be considered as a sufficient remedy, as it requires the cooperation of sanitary measures which are indispensable to its success.

Quarantine is altogether inapplicable to cholera as the plea that it is a contagious disease is altogether incompatible with Dr. Cunningham's facts. The most favourite theory is the doctrine of indirect contagion by means of the stools that contain the potential poison: after being passed, they must undergo changes in the soil or in water before they originate true cholera poison. The spores of the disease may be dormant in the soil before conditions perhaps similar to those that give rise to other epidemics rekindle them into fresh activity. Nothing more natural than to suppose that cholera stools are deposited by travellers along the most frequented thoroughfares of human intercourse, and there remain until the future date when they make their presence felt by travellers along the same route. According to this view it is not human intercourse that spreads the disease but human intercourse that carries man to places where these hidden germs of disease lurk and only require favourable conditions to bring them into activity. This explains why removal of soldiers and troops from the affected locality is attended with beneficial results, and it implies removal to places where either the spores or the conditions necessary do not exist. The occurrence of destructive epidemics on occasions of fairs and pilgrimages has been explained on theory of extensive water contamination and poisoning of thousands who partook from such dangerous sources. In some outbreaks they may be real cases of infection from the soil, the spores of the disease and the conditions for their development being believed to be always present in places where the disease is endemic. There is one difficulty in accepting theories of indirect contagion, and which cannot be disposed of except on the assumption of the transmissibility of the disease by direct contagion, and this is what Dr. Radcliffe calls the "successive chronological phenomena" exhibited in the diffusion of the disease towards Europe, especially in the epidemic of 1865. We know of no other explanation which accounts for the gradual extension of cholera westwards, along the tracks of human intercourse both by sea and land except the vague hypothesis that Dr. Bryden's aerial waves travel westward along the same lines as human intercourse. It

is impossible to form a decided opinion on the subject of contagion of cholera, although the tendency of modern opinion is fairly balanced between the European theories of indirect contagion and Dr. Cunningham's of no contagion. Judged by both these theories quarantine is altogether useless and inapplicable.

Quarantine is not theoretically applicable to yellow-fever in the endemic zone for adopting the commoner miasmatic view of the disease, the infective material is generated by the soil independent of human intercourse. The detention of persons cannot be justified in quarantines against yellow fever, especially after disinfection of the clothes. How a detention of few days can destroy any germs of disease that may be adherent to articles of merchandize must be a matter for surprise, unless this result is attributed to measures of ventilation and disinfection, especially in the holds of ships which are generally carried out by the orders of the sanitary authorities at the port of arrival. Quarantines against yellow-fever may therefore be considered unnecessary as thorough ventilation and disinfection of suspected ships may be attended with as good results as quarantine.

Our knowledge of the periods of incubation of communicable disease is not so definite as to enable us to say how long we ought to isolate a patient suffering from such disease and thus avoid the risk of infecting others, a knowledge of which with respect to each disease is essentially necessary to determine the duration of quarantine. In Dr. Squire's classification of periods of incubation, cholera and plague are classed among diseases of the shortest period lasting from one to four days, yellow-fever among the second shortest, lasting from two to six days. There are however cases of longer periods due either to individual susceptibility or to constitutional peculiarities and as a perfect system aims at preventing the introduction of single cases it must take into account the longest periods. If the longest period of incubation were taken as a guide in determining the duration of quarantine this would be far in excess of the average, and would submit a large number of individuals to unnecessary detention on account of the idiosyncrasies of the few. A quarantine, therefore, based on our imperfect knowledge of the ordinary periods of incubation can only be of uncertain advantage in preventing the spread of communicable diseases.

But the greatest argument against quarantine is derived from the repeated failures that have followed these measures during its trial in the frequent epidemics of cholera and plague that have visited us, especially since the commencement of this century.

The conclusions arrived at by the experimental method are of much greater value than mere theoretical considerations, especially as we are possessed of a number of facts the accuracy of which there can be no valid reason to doubt. Already in the seventeenth century materials must not have been wanting to frame a rational inquiry into the effects of quarantine on epidemic disease, but the facts at the disposal of scientific men of the day were so distorted by preconceived ideas and their reasons blinded by implicit faith in undeveloped theories of contagion that they were naturally prone to attribute any failures of their pet system rather to administrative defects than to unsoundness of principle.

There are two modes of investigating the value of a remedy; one by administering single doses of the remedy at varying intervals and watching both their separate and combined effect on the system, the other by administering the drug during the whole course of the disease in a series of cases and then comparing results with another series of cases in which the disease has been allowed to pursue its natural course unaffected by any powerful remedy. The administration of quarantine has not been followed by an immediate diminution of the disease. This is amply shewn in the history of the epidemics of cholera. The first failures of quarantine were attributed to imperfections and want of design in the systems then in vogue, and an attempt was made to remedy the old defects by the introduction of the rational system. Land quarantines were tried on the improved system, and found perfectly useless, as in the present epidemic in Southern Europe. One of the greatest difficulties in the practical method is how to distinguish a natural decline in the disease from the artificial effect of a drug, an every-day one in clinical medicine. The successes that have been attributed to quarantine especially against plague were only apparently so, being now explained by the gradual diminution of the disease which commenced in the seventeenth century. That the limitation of plague to certain districts in the recent outbreaks was rather a character of the disease than the effect of quarantine has been shown when speaking of plague.

The second mode of investigation in rational therapeutics has been applied by Dr. Tholazan to quarantine in his valuable work where he ably maintains that a comparison of epidemics in which quarantine has been enforced with others in which no restrictive measures were taken, thus exhibiting the natural progress of the epidemics, did not warrant the conclusion that quarantine had in any way influenced the severity, duration, or course of the disease.

An objection may however be brought against both these methods of reasoning, that quarantine ought not to be judged by the imperfect attempts that have been made at different times, and that with renewed endeavours, we may gradually attain to a most successful system. Such people ought to see that apart from the difficulties of organizing a complicated system like quarantine and the abuses connected with institutions in which inducements to evade restrictions exist, there are inherent difficulties as our imperfect knowledge of periods of incubation which must make quarantine measures always uncertain.

I need not dwell on the manifold difficulties of quarantine organization, its abuses, and its baneful effects on the commercial relations of the human family as these have already been referred to. Even if the results of quarantine were more favourable, I do not know that these disadvantages would not considerably detract from its value as a preventive remedy. These disadvantages are found both in land and maritime quarantines and I have already mentioned instances of laxity in quarantine administration noticed by Dr. Simpson and the German Cholera Commission. But one link in the evidence against quarantine is wanting to make it complete, on account of the many difficulties in forming a conclusion as to the utility of the measures in the Red Sea. Even if it could be proved that notwithstanding these measures, cholera was imported from India in 1873, it might be alleged that the disease leaked out through some imperfection or temporary relaxation, the result of negligence of the sanitary authorities. To establish the uselessness of maritime quarantine, it must be shown that epidemics will not increase after the abandonment of these measures. But considerations such as those brought forward at the Roman Conference by the British and Indian delegates ought to be strong enough to induce international bodies to try the crucial experiment by a temporary abandonment, at least, of quarantine in the Red Sea, that they might be able to watch the results of such a step.

I may now sum up :—Land quarantine is of no advantage whatsoever in preventing the spread of communicable diseases, but evidence is not conclusive to show the utility or inutility of maritime quarantine in the Red Sea: if we assume the utility of these measures, the practical difficulties of maintaining an efficient quarantine must in a great way tend to neutralize its beneficial effects.

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Digitized with financial assistance from
Government of Maharashtra
on 30 January, 2020